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STUDY OF MICROORGANISMS PRESENT IN BORE HOLE WATERAND POND WATER USED FOR AGRICULTURAL IRRIGATION AND ANALYSIS OF THEIR BENEFICIAL EFFECTS ON CROP GROWTH

N. Swamy* and Dr.Madan Mohan Gunda

Department of Microbiology, Government Degree and PG College(A), Siddipet, Telangana, India.
Shyamneela5674@gmail.com

ABSTRACT

Water used for agricultural irrigation contains a variety of microorganisms that significantly influence soil fertility and crop productivity. The present study was conducted to isolate, identify and evaluate microorganisms present in bore hole water and pond water used for irrigation in agricultural fields. A total of 20 water samples (10 bore holes and 10 pond water samples) were collected from different agricultural areas. Standard microbiological methods were employed for the isolation and identification of bacteria and fungi. The microbial load was determined using serial dilution and plate count techniques, various beneficial microorganisms such as *Bacillus* spp, *Pseudomonas* spp, *Azotobacter* spp, *Rhizobium* spp, *Trichoderma* spp and *Aspergillus* spp were identified. The isolates were further screened for plant growth promoting activities such as nitrogen fixation, phosphate solubilization and production of plant growth hormones. The results indicated that pond water harbored a higher microbial diversity compared to bore hole water. These microorganisms exhibited significant beneficial effects on crop growth and soil fertility.

KEYWORDS

Irrigationwater, Bore hole water, Pond water, Beneficial microorganisms, Crop growth, Phosphate solubilization,Nitrogen fixation.

INTRODUCTION

Agriculture is the backbone of the Indian economy and irrigation water plays a crucial role in crop production. Besides supplying moisture, irrigation water serves as reservoir diverse microorganisms present in irrigation water contribute to

Nutrient cycling
Nitrogen fixation
Phosphate solubilization
Organic matter decomposition Disease
suppression

Plant growth promotion environment and generally contains a rich microbial population. Bore hole water although relatively cleaner also contains microorganism that influence crop growth understanding the microbial diversity of irrigation water can help in improving agricultural productivity through sustainable and ecofriendly approaches.
Several researchers have reported the importance of microbial communities in different water bodies used for agricultural purposes. Singh et al. (2010) observed that irrigation water sources contain diverse microbial populations that influence nutrient cycling and environmental quality. Similarly, Panneerselvam and Arumugam (2012) isolated various bacterial species from lake water and emphasized their ecological significance. Sharma et al. (2008) reported that aquatic ecosystems support a wide range of microorganisms involved in nutrient transformation and organic matter decomposition.

Kataria et al. (2016) studied the microbiological characteristics of river water and demonstrated the role of indigenous microorganisms in maintaining ecological balance. Rajiv et al. (2012) compared the microbial quality of pond water sources and reported considerable variations in microbial abundance depending on environmental conditions. According to Jung et al. (2014), monitoring microbial populations in water resources is essential for assessing water quality and its agricultural suitability.

Beneficial microorganisms present in irrigation water play an important role in sustainable agriculture by enhancing nutrient availability, improving soil structure, promoting plant growth, and suppressing plant pathogens. These microorganisms contribute significantly to soil fertility and crop productivity through biological processes such as nitrogen fixation, phosphate solubilization, siderophore production, and synthesis of plant growth-promoting substances. Therefore, understanding the microbial diversity of bore hole water and pond water is essential for developing eco-friendly agricultural practices and improving crop yield under sustainable farming systems.

METHODOLOGY

Study area

The study was conducted in different agricultural fields of Anajipur, Siddipet district where bore hole and pond water are commonly used for irrigation.

Sample collection

A total of 20 water samples were collected.

Table 1: Collected samples.

SL No	Bore hole water	Pond water	Total
1	10	10	20

Samples were collected aseptically in sterile bottles and transported to the microbiology laboratory for analysis.
Microbiological analysis
Total viable count
Serial dilution technique was used.
One ml waster sample was added to 9 ml sterile saline.
Serial dilutions were prepared up to 10-6.
Aliquots were prepared on nutrient agar plates.
Plates were incubated at 37 degrees Celsius for 24 – 48 hours.

Isolation of microorganisms

Table 2: Different media were used

Medium	Purpose
Nutrient agar	Total bacteria
MacConkey agar	Gram negative bacteria
Pikovskaya's Agar	Phosphate solubilizers
Jensen's medium	Nitrogen fixers
PDA	Fungi

Identification of isolates

Morphological examination

Colony side

Shape

Colour

Margin

Microscopic examination

Gram staining

Fungal staining techniques

Biochemical tests

Catalase test

Oxidase test

Citrate utilization

Indole test

Urease test

Figure 1. Serial dilution

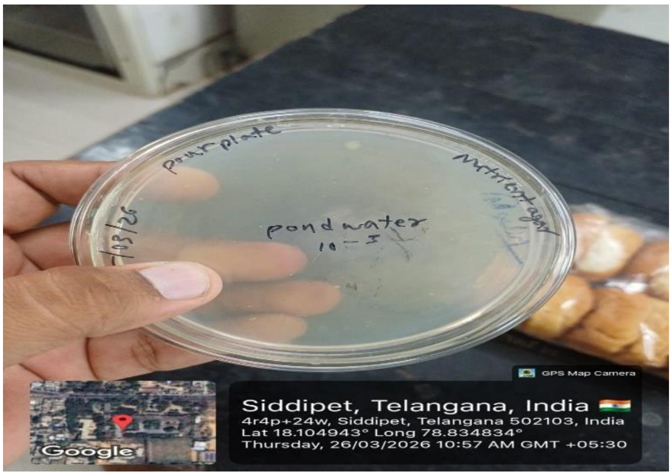

Figure 2. bacterial growth

Figure 3. *E. coli*

RESULTS

Table 3: Microbial population in water samples.

SL No	Water Source	Average bectarial count (CFU/ml)
1.	Bore hole water	2.8 x 10
2.	Pond water	6.5 x 10

Pond water showed significantly higher microbial population than bore hole water.

Table 4: Beneficial microorganisms isolated.

Microorganisms	Bore Hole Water	Pond Water
Bacillus spp	8	15
Pseudomonas spp	5	12
Azotobacter spp	3	10
Rhizobium spp	2	8
Trichoderma spp	1	6
Aspergillus spp	2	7

Table 5: Plant growth promoting activities

SL No	Activity	Positive Isolates (%)
1.	Nitrogen Fixation	65%
2.	Phosphate solubilization	72%
3.	IAA production	58%
4.	Siderophore production	54%

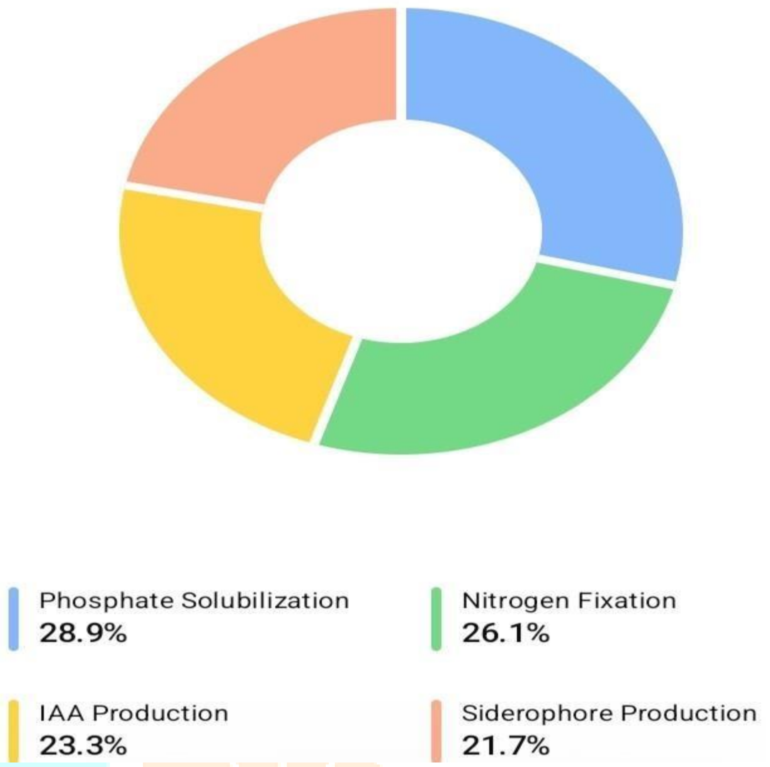

Figure 4: Plant growth promoting activities

DISCUSSION

The present study demonstrated that both bore hole and pond water contains diverse beneficial microorganisms. Pond water exhibited higher microbial diversity due to the presence of organic matter and environmental exposure.

The predominant bacterial genera identified wise *Bacillus*, *Pseudomonas*, and *Azotobacter*. These organisms are well known for promoting plant growth through nutrient mobilization and production of plant growth – promoting substances. Phosphate solubilization bacteria improved phosphorus availability. While nitrogen – fixing bacteria enhanced nitrogen supply to crops. Fungal isolates such as *Trichoderma* contribute to disease suppression and improved root development.

The findings indicate that irrigation water can act as a natural source of beneficial microorganisms and contribute to sustainable agricultural production.

The findings of the present investigation are in agreement with the observations of Singh et al. (2010), who reported substantial microbial diversity in natural water bodies. The higher microbial population observed in pond water compared to bore hole water may be attributed to greater organic matter content, nutrient availability, and continuous exposure to environmental factors. Similar observations were reported by Rajiv et al. (2012) during their comparative analysis of pond water ecosystems.

The predominance of *Bacillus* spp., *Pseudomonas* spp., *Azotobacter* spp., and *Rhizobium* spp. Observed in this study supports the findings of Panneerselvam and Arumugam (2012), who identified several beneficial bacterial groups in freshwater environments. These microorganisms are recognized for their ability to improve plant growth through nutrient mobilization and production of growth-promoting metabolites.

The significant phosphate-solubilizing activity recorded in the present study indicates the potential role of these microorganisms in enhancing phosphorus availability to plants. Likewise, nitrogen-fixing bacteria contribute to natural enrichment of soil nitrogen, reducing dependence on chemical fertilizers.

Sharma et al. (2008) and Kataria et al. (2016) also highlighted the ecological importance of such microbial communities in nutrient cycling processes.

The isolation of *Trichoderma* spp. Further suggests the presence of naturally occurring biocontrol agents in irrigation water. *Trichoderma* species are widely known for suppressing plant pathogens, improving root development, and enhancing nutrient uptake. The present findings therefore indicate that irrigation water serves not only as a source of moisture but also as a reservoir of beneficial microorganisms that can contribute to sustainable agricultural productivity and environmental health.

Overall, the results emphasize the agricultural significance of microbial populations present in irrigation water and support the use of microbial resources for eco-friendly crop management practices.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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